

CV	Description	Area	Value*
1	Locomotive address	DCC: 1 - 127 Mot: 1 - 80	3
2	Minimum speed (the speed from 0 until the locomotive is running at speed step 1)	0 - 255	0
3	Acceleration delay	0 - 255	50
4	Braking delay	0 - 255	30
5	Maximum speed (must be greater than CV 2)	0 - 255	195
6	Average speed (must be greater than CV 2 and less than CV 5)	0 - 255	135
7	Firmware version (The processor can be updated)	-	differently
8	Manufacturer's ID Decoderreset CV8 = 8	-	162
12	<b>Decoder operating mode</b>	<b>Value</b>	0 - 117
	Bit 0=1 DC (analog operation; direct current) on	*1	
	Bit 2=1 DCC data format on	*4	
	Bit 4=1 AC (analog 3-rail operation; alternating current) on	*16	
	Bit 5=1 Motorola® data format on	*32	
17	Long locomotive address	1 - 10239	1000
18	17 = high Byte	192 - 231	195
	18 = low Byte	0 - 255	232
27	<b>Brake signal settings (automatic stop)</b>	<b>Value</b>	0 - 51
	Bit 0 = 1 -> ABC (Automatic Brake Control) right rail positive	1	
	Bit 1 = 1 -> ABC left rail positive	2	
	Bit 4 = 1 -> DC; opposite direction of travel	16	
	Bit 5 = 1 -> DC; same direction of travel	32	
29	<b>DCC standard configuration</b>	<b>Value</b>	0 - 63
	Bit 0=0 Normal direction of travel	*0	
	Bit 0=1 Opposite direction of travel	1	
	Bit 1=0 14 speed steps	0	
	Bit 1=1 28 speed steps	*2	
	Bit 2=0 Digital mode only	0	
	Bit 2=1 Automatic analog/digital recognition	*4	
	Bit 3=0 RailCom® turned off	0	
	Bit 3=1 RailCom® turned on	*8	
	Bit 4=0 Speed steps over CV 2, 5, and 6	*0	
Bit 4=1 Use the characteristic curve from CV 67 - 94	16		
Bit 5=0 Short address (CV1)	*0		
Bit 5=1 Long address (CV 17/18)	32		
30	<b>Error codes for the motor, thermal overload, and function outputs:</b> 1 = motor error, 2 = thermal overload error, 4 = function output error	0 - 7	0

\* set ex works

**NOTE:** This product is not a toy and is not intended for children under 14 years of age. Any liability for damage of any kind caused by improper use or failure to observe these instructions is excluded.

#### Service:

www.piko-america.com  
support@piko-america.com  
619-280-2800

In the event of a problem with this decoder, return it to PIKO along with proof of purchase and a short description of the problem.

#### Warranty Statement

Each decoder module is fully tested before shipment. Nevertheless, should a malfunction occur within the 2-year warranty period, we will repair the module free of charge on presentation of the proof of purchase. This warranty is voided if the unit has been damaged by improper use. Please note that, according to the German Electromagnetic Compatibility Law (EMV-Gesetz), the decoder module may only be used inside models bearing the CE mark.

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**PIKO SmartDecoder XP 5.1 Sound PluX22**  
for Diesel Loco KM ML4000 H0  
multiprotocol, mfx® capability included



**NOTE:** Detailed information on the PIKO SmartDecoder XP 5.1 Sound is available as a PDF file on our Webshop on the page of the respective item number. The file contains a full description of all functions and operating possibilities for the new SmartDecoder XP 5.1 Sound.

#### Description

The state-of-the-art PIKO SmartDecoder XP 5.1 Sound inside in this PIKO locomotive is a compact yet powerful multi-protocol PluX22 sound decoder. It features high fidelity, 12 bit 8-channel sound with 2.5 watts of output that ensures distortion-free sound at all levels. It complies with the current RCN standards in all areas. The decoder can be used on DCC, mfx®, and Motorola® digital systems as well as traditional DC or AC analog layouts. It automatically senses what operating mode is used on your layout and is RailCom®/RailCom Plus® compatible. The PIKO SmartDecoder XP 5.1 Sound features several programmable braking distance functions in addition to numerous other programmable functions.

The PIKO SmartDecoder XP5.1 Sound is load-regulated and features auto-adaptive motor control that works with of a fundamentally newly developed traditional DC motors for a silky smooth ride as well as 1.2 Amp coreless motors. The decoder will also tolerate a temporary current draw up to 2 Amps. The motor speed table can be set using the minimum, median, and maximum motor speed (simple curve), or by the user-programmable 28-speed step extended curve. The decoder features two directional lighting outputs and seven additional special function outputs that can be activated using function keys up to F68 (DCC). The switching (shunting) gear, with extended slow speed range, the three possible starting and braking delays, as well as the many vehicle sounds are also switchable via function keys. The sound part can control specified function outputs as well as the motor output of the decoder. For example, the lighting of a diesel locomotive flickers when the engine is started. The PIKO SmartDecoder XP 5.1 is supported by the further developed power management in case of short-term voltage loss.

#### Installing the PIKO SmartDecoder XP 5.1 Sound

Remove the jumper plug from your model's PluX22 interface. Insert the new sound decoder into the interface socket. Note that PIN 11 is missing on the new decoder. Please install the loudspeaker as shown in the graphic of the "Spare parts list". Check for crossed wires and short circuits before and after reinstalling the shell. Place the model on your programming track with programming mode activated on your DCC system. During programming or when reading the model's DCC address, a small amount of current will flow through the model, which does not affect the decoder; even in the event of a short circuit.

#### Special function outputs A1 to A7

The decoder's special function outputs A1 to A7 can only be activated if the desired functions are already connected to the model's PluX22 interface or if solder pads are available for the special function outputs on the main circuit board.

**A short circuit in the motor, lighting, pick-up wiper, or wheelsets can destroy the decoder as well as the electronics of the model!**

#### First-time use of the decoder (state of delivery)

Enter address 3 on your digital control system. Depending on the data format used to address the sound decoder, the locomotive runs in DCC mode with 28 speed steps or in Motorola® mode. When using a RailCom Plus®-enabled system or with an mfx®-capable system, the decoder is detected automatically and can be operated immediately. If the decoder is used on a conventional analog layout, it can be controlled with a DC or AC power pack. The decoder will automatically detect the layout's operating mode.

**NOTE:** In DC mode, your vehicle will not start until the voltage is higher (speed control turned up further) than you may have been used to when operating with analog vehicles.

#### Function outputs in analog mode

It is possible to program the decoder so that function keys F0 - F12 (as they are assigned in the function mapping) can also be activated in analog mode. To do this, CVs 13 & 14 must first be programmed with a central control unit. The corresponding values can be found in the CV table of the detailed operating instructions.

## Motorola®

The decoder utilizes 4 Motorola® addresses to access functions F1 - F 16, when using a Motorola—based command station. The three sequence addresses for the functions F5 - F16 are ascending to the decoder address and can be activated in CV61 as required by the values 1 (F5 - F8), 2 (F5 - F12), or 3 (F5 - F16).

## Configuration of CVs

CVs 12 and 29 control the operating mode and configuration CVs, respectively. As a rule, an indexed CV contains various basic settings of a decoder, such as reversing the direction of travel. CV calculation examples can be found in the detailed operating instructions.

## RailCom®, RailCom Plus®

In the sound decoder, CV29 (RailCom®) can be turned on or off via bit 3. The decoder is automatically recognized by RailCom Plus® - equipped command stations (like PIKO SmartControl<sup>WLAN</sup>) if the RailCom Plus® option is activated in CV 28. The decoder name, locomotive symbol, and special function symbols will appear automatically on your control device's screen. With RailCom Plus® technology, no locomotive data has to be stored in the DCC central control unit and no locomotive addresses have to be programmed into the decoder.

## mfx®

The PIKO SmartDecoder XP 5.1 Sound also masters the mfx® data format. The decoder is automatically recognized on mfx®-equipped command stations. The decoder name and its maximum of function symbols automatically.

This mfx® technology means that no locomotive data has to be stored in the command station and no locomotive addresses have to be programmed into the sound decoder.

## Braking

The sound decoder understands the following braking methods:

Märklin® braking section (brakes with analog DC voltage)

DCC braking function

ABC (Automatic Brake Control) braking section

The decoder's adjustable braking distance can bring the train to a stop within a centimeter of a signal. More information on "braking behavior" can be found in the detailed operating instructions for PIKO SmartDecoder XP 5.1 Sound.

## Function outputs

A comprehensive description of all options related to the function outputs can be found in the detailed operating instructions.

## Simple and extended function mapping

Easy-to-use **function mapping** allows you to assign functions like lighting and other outputs to any key between F0 – F12. Acceleration, braking delay, and switching (shunting) mode can be assigned to any function keys using CVs 156 and 157.

## Smoke generator control

A smoke generator can be connected to outputs A1 to A7 which are load-sensitive and react to the model's speed. Function key assignment is done using extended function mapping.

## Electric coupler control

PIKO electric couplers are operated by tiny copper wire resistance wires which heat up when the decoder sends current through them. The heat causes the wires to expand, causing the coupler hook to move to the uncoupled position. The model can then back away from the car. With the appropriate decoder settings, function outputs A4 and A5 will automatically switch off after a user-adjustable time without having to press their function key.

## Switching (shunting) scenario, remote coupling/uncoupling

If your layout has remote electric uncouplers installed, you can program the locomotive decoder to perform a switching scenario like the following:

- 1) The locomotive runs in one direction for a certain distance.
- 2) The locomotive stops and reverses direction.
- 3) The locomotive uncouples and moves back from the uncoupled car for a certain distance.
- 4) The locomotive stops, and resumes switching..

## Extended function mapping

Due to its complex nature, extended **function mapping** cannot easily be set by programming individual CVs. To work with extended **function mapping**, you will need the PIKO SmartProgrammer device (#56415) and, if desired, the PIKO SmartTester (#56416). Detailed information on extended function mapping is available in the instruction manual.

## Servo control

The sound decoder enables the control of servo motors via all function outputs. The assignment to the function keys is done exclusively via the extended function mapping.

The use of a servo with the decoder requires electronics expertise.

Further information can be found in the detailed operating instructions.

**ATTENTION:** Soldering on the decoder should only be carried out by experienced specialists with the appropriate tools. Decoders damaged by improper handling will not be covered by the warranty.

## Sound settings

To change the overall sound volume of the SmartDecoder XP 5.1 Sound, first program CV31 to a value of 16 and CV32 to a value of 0. This will take you to the programming area for setting the total volume. You can now set this as you wish in CV257 in the value range 0 - 255.

NOTE: In order to play a PIKO sound on the sound decoder, the test and programming device requires PIKO SmartProgrammer (#56415) and (optional) the PIKO SmartTester (#56416). All further information about the sound section of the PIKO SmartDecoder XP 5.1 Sound as well as the available For setting options, please refer to the detailed operating instructions.

**Factory reset** To restore the sound decoder to its factory settings, program CV8 to a value of 8.

## Programming

Configuration variables (CVs) form the basis of all the decoder's settings. This decoder can be used with the PIKO SmartControl<sup>light</sup> DCC system, the PIKO SmartControl DCC system, or any other Motorola-based system. For more information on programming options, please refer to the instruction manual.

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## Function assignments

F0	Headlights	F10	Dual White Gyalalite	F20	Radiator Fan Sound
F1	Bell	F11	Red Gyalalite	F21	Sander Valve Sound
F2	Horn - Playable	F12	-	F22	Cab Chatter
F3	Short Horn	F13	Cab Interior Light	F23	Cab Chatter
F4	Dynamic Brake Sound	F14	Engine Room Light	F24	Air Compressor Sound
F5	Manual Notch Up	F15**	Lighting double traction*	F25	Control Stand Light
F6	Manual Notch Down	F16	Volume Stepper - 4 Steps	F26	Crade Crossing Horn
F7	Headlight Dimmer	F17	Couple/Uncouple Sound	F27	-
F8**	Motor Sounds	F18	Brake Squeal/Release	F28	Switching Mode/Half Speed
F9**	Indicators & Marker Lights	F19	Curve Squeal Sound		


\* depending on version

\*\*Note: This sound decoder features several "multi-step" functions. Each successive press of the button activates a different condition of that function, as noted here:


### F8 Motor Sounds

- 
- 1x 1 Motor
  - 2x 2 Motors
  - 3x Motors off
  - 4x Sound off

### F9 Indicators & Marker Lights

- 
- 1x Loco ID boards on in forward mode
  - 2x Loco IDs and white classification on in forward mode
  - 3x Loco IDs and green classification on in forward mode
  - 4x red classification on in reverse mode
  - 5x initial state ID and classification lights off

### F15 Lighting double traction\*

- 
- 1x all front lights off
  - 2x all rear lights off
  - 3x both sides off
  - 4x initial state lights on both sides